

REMARKS

This paper responds to the Office Action mailed on May 2, 2007.

Claims 1, 3-6, 10-11, 31-34, 39 and 42 are amended, claims 12-23 and 35-38 are canceled without prejudice or waiver of patentable content, and no claims are added; as a result, claims 1-11, 24-34 and 39-42 are now pending in this application.

§112 Rejection of the Claims

Claims 3-6, 10-11, 14-15, 16-20, 22-23, 31-34 and 42 were rejected under 35 U.S.C. § 112, first paragraph, as lacking adequate description or enablement. Applicant respectfully disagrees with this rejection for the reasons provided in the prior response, but in order to advance the prosecution of this application, Applicant has amended claims 3-6, 10-11, 31-34 and 42 to clarify that the concentration ratio is a volume concentration ratio, as the Examiner noted in the previous Office Action dated December 29, 2006 in paragraph 8. Applicant has cancelled claims 14-15, 16-20, and 22-23 without prejudice or waiver of patentable subject matter, and retains the right to resubmit these claims in subsequent continuation or divisional applications. Applicant requests that this rejection be withdrawn in view of the claim amendments and cancellations.

Claims 3-6, 10-38 and 42 were rejected under 35 U.S.C. § 112, second paragraph, for indefiniteness, specifically whether the concentration ratios recited are volume, weight or molar concentrations. Applicant again respectfully disagrees with this rejection regarding the concentration ratios, but in order to advance the prosecution of this application, Applicant has amended the claims to clarify that a volume concentration ratio is meant, as the Examiner assumed in the previous Office Action. Applicant requests that this rejection be withdrawn in view of the claim amendments.

§103 Rejection of the Claims

Claims 1-4, 7-14, 16-21, 24-35, 37 and 39-41 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Liu et al. (U.S. 7,064,078) in view of Szwejkowski et al. (U.S. 5,147,499). Applicant respectfully traverses this rejection. Claims 12-14, 16-21, 35 and 37 are canceled without prejudice herein.

Liu discloses a process that uses a first photoresist mask 106 to etch a first pattern 108 in an amorphous carbon hard mask 104, then entirely removing the first photoresist 106 (see figure 2C). Then a second different photoresist mask 110 is patterned to form and to etch a second pattern 112 on the same hard mask 104, and then completely removing the second photoresist (see figure 2E). Then the combined pattern in the hard mask 104 of the first and the different second masks (108 and 114) is used to etch a pattern 116 into the substrate 102. Liu discloses a non carbon cap layer 205 disposed on the amorphous hard mask layer 204, that is used to “protect the amorphous carbon layer during processing steps such as the removal of the photoresist” (col. 5, lines 65-66), and may be used as an anti-reflection coating.

Applicant is unable to find any indication in Liu of a problem with residual photoresist material remaining after the removal of the photoresist. Liu does suggest *patterning a carbon-containing hard mask over a substrate with a resist; removing the resist*, but does not suggest either a resist stack or the use of a single resist layer, and has no suggestion of any sort of *surface treating the substrate to remove residual resist under conditions that are selective to the hard mask and to the substrate*, since there is nothing related to residual resist in Liu, or any recognition of such an issue existing, as admitted by the Examiner on page 5, second paragraph of the outstanding Office Action.

Szwejkowski discloses a method of removing a silicon and oxide containing sidewall material 26, inadvertently formed during polysilicon anisotropic etch forming the polysilicon layer 20 into polysilicon line 28. The sidewall material 26 is formed of silicon and oxides, and as discussed at least at column 1, lines 32-42, and column 2, lines 4-11, is not suggested to be a residual portion of the photoresist 32, or to have any relationship to any photoresist or organic polymer material. Sidewall material 26 is stated to conventionally be removed by HF, and is

stated to be formed of silicon and oxides (see col. 2, lines 29-38; col. 3, lines 5-11) and “not purely polysilicon” (see col. 3, line 8), clearly indicating to one of ordinary skill in the art that this is not a photoresist residue. Applicant can find nothing in the cited reference suggesting that the silicon and oxide film 26 is residual photoresist, and the suggested methods, such as HF etching, are clearly directed towards dielectric materials, and would have no affect on residual photoresist, such as found in the present application.

Applicant respectfully submits that the suggested combination of references fails to describe or suggest at least the claimed features of “...*patterning a carbon-containing hard mask over a substrate with a resist; removing the resist; and surface treating the substrate to remove residual resist disposed in contact with the substrate under conditions that are selective to the hard mask and to the substrate...*”, as recited in independent claim 1, as amended herein, from which claims 2-6 depend. Neither reference suggests a photoresist residue, and certainly not a photoresist residue in contact with the substrate.

For similar reasons, Applicant respectfully submits that the remaining independent claims are also patentable over the suggested combination of references. The dependent claims are believed to be patentable at least as depending from patentable base claims as shown above, since any claim depending from a nonobvious independent claim is also nonobvious. See M.P.E.P. § 2143.03. In view of the above noted claim amendments, and discussion of the failure of the references to describe or suggest at least removing residual photoresist, Applicant requests this rejection under 35 U.S.C. § 103(a) be reconsidered and withdrawn.

Claims 5-6, 11, 15-16, 25-29 and 31-34 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Liu et al. and Szwejkowski et al. as applied to claims 1-4, 7-14, 16-21, 24-35, 37 and 39-41 above, and further in view of Chen et al. (U.S. Publication 2005/0026435). Claims 15-16 are cancelled without prejudice herein.

The cited references of Liu and Szwejkowski lack the features discussed above with reference to the previous rejection. Chen is used in the outstanding Office Action to show that solutions of ammonium hydroxide and peroxide are known. Applicant respectfully submits that

the addition of Chen does nothing to cure the above noted failure of the other references to suggest a surface treatment to remove residual photo resist material.

Applicant respectfully submits that the suggested combination of references fails to describe or suggest at least the claimed features of “...*patterning a carbon-containing hard mask over a substrate with a resist; removing the resist; and surface treating the substrate to remove residual resist disposed in contact with the substrate under conditions that are selective to the hard mask and to the substrate...*”, as recited in independent claim 1, as amended herein, from which claims 5-6 depend. Neither reference suggests a photoresist residue, nor a photoresist residue in contact with the substrate.

For similar reasons, Applicant respectfully submits that the remaining independent claims are also patentable over the suggested combination of references. The dependent claims are believed to be patentable at least as depending from patentable base claims as shown above, since any claim depending from a nonobvious independent claim is also nonobvious. See M.P.E.P. § 2143.03. In view of the above noted claim amendments, and discussion of the failure of the references to describe or suggest at least removing residual photoresist, Applicant requests this rejection under 35 U.S.C. § 103(a) be reconsidered and withdrawn.

Claims 21-23, 37-38 and 42 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Liu et al. and Szejewski et al. as applied to claims 1-4, 7-14, 16-21, 24-35, 37 and 39-41 and further in view of Fang et al. (U.S. Publication 2005/0161338). Claims 21-23 and 37-38 are canceled without prejudice herein.

The cited reference of Liu and Szejewski lack the features discussed above with reference to the previous rejection. Fang is used in the outstanding Office Action to show that it is known to use solutions including sulfuric acid and citric acid. Applicant respectfully submits that the addition of Fang does nothing to cure the above noted failure to suggest a surface treatment to remove residual photo resist material.

Applicant respectfully submits that the suggested combination of references fails to describe or suggest at least the claimed features of “...*patterning a carbon-containing hard mask*

over a substrate with a photoresist; removing the photoresist; surface treating the substrate to remove residual photoresist in contact with the substrate under conditions that are selective to the hard mask and to the substrate; and dry etching the substrate through the hard mask...”, as recited in independent claim 39, as amended herein, from which claim 42 depends. The cited references, whether taken alone or in any combination, do not suggest a surface treatment to remove residual photoresist or photoresist in contact with the substrate. Thus, the suggested combination of references, even if there were proper motivation shown to make the combination, still does not suggest at least the above recited feature of the claims. In view of the above discussion and claim amendments, Applicant requests this rejection under 35 U.S.C. § 103(a) be reconsidered and withdrawn.

Provisional Double Patenting Rejection

Claims 12-23 and 35-38 were provisionally rejected under 35 U.S.C. 101 of double patenting over claims 1-12 and 24-27 of co-pending Application No. 11/494,056. Claims 12-23 and 35-38 are cancelled without prejudice herein, and Applicant requests this rejection be withdrawn.

Claims 1-11, 24-34 and 39-42 were provisionally rejected under a non-statutory obviousness-type double patenting rejection, over claims 13-16, 19-20 and 23-34 of co-pending Application No. 11/494,056

Applicant does not admit that the claims are obvious in view of co-pending Application No. 11/494,056. However, a Terminal Disclaimer in compliance with 37 C.F.R. 1.321(b)(iv) will be considered to obviate this rejection upon indication of allowance of the claims.

Reservation of Rights

In the interest of clarity and brevity, Applicant may not have addressed every assertion made in the Office Action. Applicant's silence regarding any such assertion does not constitute any admission or acquiescence. Applicant reserves all rights not exercised in connection with this response, such as the right to challenge or rebut any tacit or explicit characterization of any

reference or of any of the present claims, the right to challenge or rebut any asserted factual or legal basis of any of the rejections, the right to swear behind any cited reference such as provided under 37 C.F.R. § 1.131 or otherwise, or the right to assert co-ownership of any cited reference. Applicant does not admit that any of the cited references or any other references of record are relevant to the present claims, or that they constitute prior art. To the extent that any rejection or assertion is based upon the Examiner's personal knowledge, rather than any objective evidence of record as manifested by a cited prior art reference, Applicant timely objects to such reliance on Official Notice, and reserves all rights to request that the Examiner provide a reference or affidavit in support of such assertion, as required by MPEP § 2144.03. Applicant reserves all rights to pursue any cancelled claims in a subsequent patent application claiming the benefit of priority of the present patent application, and to request rejoinder of any withdrawn claim, as required by MPEP § 821.04.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney David Suhl at (508) 865-8211, or the undersigned attorney at (612) 349-9587 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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Date

28 June '07

By


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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 28 day of June 2007.

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